

REMARKS

Applicants thank the Examiner for the very thorough consideration given the present application.

Claims 1-20 are now present in this application. Claims 1 and 13 are independent.

Amendments have been made to the Title, and the Abstract of the Disclosure, and claims 1 and 13 have been amended. No new matter is involved.

Reconsideration of this application, as amended, is respectfully requested.

Priority Under 35 U.S.C. § 119

Applicants thank the Examiner for acknowledging Applicants' claim for foreign priority under 35 U.S.C. § 119, and receipt of the certified priority document.

Information Disclosure Citation

Applicants thank the Examiner for considering the references supplied with the Information Disclosure Statements filed on April 19, 2006 and June 7, 2006, and for providing Applicants with an initialed copy of the PTO-1449 form and the PTO/SB/08 form filed therewith.

Objections to the Drawings

The Examiner has objected to the drawings because, allegedly, they fail to show vital details of the gear reduction mechanism. Allegedly, Figs. 3, 5, 7 and 9 fail to show the number of planetary gears, and their connection to the secondary shaft is not obvious and is confusing. Also, the Office Action asserts that the drawings do not show reference numeral 50.

These objections are respectfully traversed.

Initially, Applicants note that the burden is on the Office to establish a *prima facie* case of non-compliance with the patent statutes and Rules of Practice, including 37 CFR §1983(a), which forms the basis for the objection to Figs. 3, 5, 7 and 9. The Examiner has to provide objective factual evidence in support of establishing a *prima facie* case of non-compliance with

37 CFR §1.83(a). Instead of doing this, the Office Action merely makes speculative, conclusionary statements unsupported by objective factual evidence. Moreover, these statements are contradicted by the references used to reject Applicants' claimed invention. For example, U.S. Patent 6,176,108 to Bae et al. ("Bae") only shows side views of its planetary gear systems, both for the prior art Figs. 7 and 9, and for its inventive figures 1, 2 and 6. Applicants respectfully submit that Applicants' Figs. 3, 5, 7 and 9 show more detail of their planetary gear systems in those figures than does Bae in its Figs. 1, 2 and 6.

Further, in this regard, Applicants attach a copy of a five-page (pages 77-81) 2002 article from the University of Waterloo, Canada, Department of mechanical Engineering, which shows a front and a side view of a planetary gear system, wherein the side view is similar to Applicants' side view of a sun gear and related planetary gears in Figs. 3, 5, 7 and 9. The Internet website address for this article is "mecheng1.uwaterloo.ca".

Applicants respectfully submit that the depiction of the planetary gear train arrangement in their Figs. 3, 5, 7 and 9 is clear to one of ordinary skill in the art, as is the similar depiction of a planetary gear train in the aforementioned article.

With respect to numeral 50, this numeral is shown in Applicants' Fig. 3, as the lowest numeral in that figure, i.e., closest to the bottom of the figure.

Accordingly, the Office Action fails to make out a prima facie case that the drawings do not comply with the provisions of USPTO Rules of Practice 83 and 84.

Reconsideration and withdrawal of this objection are respectfully requested.

Objection to the Title of the Invention

The Title of the Invention is objected to for not being descriptive. In order to overcome this objection, Applicants have amended the Title of the Invention in order to better reflect the subject matter claimed. Reconsideration and withdrawal of this objection are respectfully requested.

Objection to the Abstract of the Disclosure

The Examiner has objected to the Abstract of the Disclosure because it is limited to the subject matter of claim 1. In order to overcome this objection, Applicants have amended the Abstract of the Disclosure to mention more detail than what is recited in claim 1.

Accordingly, reconsideration and withdrawal of this objection are respectfully requested.

Rejection Under 35 U.S.C. § 102

Claims 1, 3, 5 and 6 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 6,176,108 to Bae et al. ("Bae"). This rejection is respectfully traversed.

A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

During patent examination the PTO bears the initial burden of presenting a *prima facie* case of unpatentability. In *re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992); In *re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). If the PTO fails to meet this burden, then Applicants are entitled to the patent.

Applicants respectfully submit that the PTO has failed to meet this burden.

A prior art reference anticipates the subject matter of a claim when that reference discloses every feature of the claimed invention, either explicitly or inherently. In *re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and *Hazani v. Int'l Trade Comm'n*, 126 F.3d 1473, 1477, 44 USPQ2d 1358, 1361 (Fed Cir. 1997). While, of course, it is possible that it is inherent in the operation of the prior art device that a particular element operates as theorized by the examiner, inherency may not be established by probabilities or possibilities. In *re Oelrich*, 666 F.2d 578, 581, 212 USPQ 323, 326 (CCPA 1981) and In *re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993).

All words in a claim must be considered in judging the patentability of that claim against the prior art. In *re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Bae differs substantially from the claimed invention. Independent claim 1 recites a combination of features, including a rotation transmission means for transmitting a rotational

force of the induction motor to rotate the inner tub with a rotational speed lower than a rotational speed of the induction motor in laundering operation, and to rotate the inner tub with a rotational speed identical to the rotational speed of the induction motor in dehydrating operation.

Bae's transmission only rotates the pulsator 3 at a reduced velocity and does not rotate the tub 102 at the reduced velocity (col. 6, lines 3-19), as claimed. Bae explicitly discloses that when it rotates the tub 102, there is no reduction of the rotational velocity in the planetary gear assembly (col. 6, lines 43-60).

Further, with respect to claim 3, Bae's lower clutch 163 is not (as asserted in the rejection) a "first spline shaft formed on a circumference of a connecting shaft for connecting the sun gear with the induction motor." In this regard, Applicants note that the Office Action fails to explain what element in Bae is the connecting shaft with respect to which lower clutch 163 is formed on a circumference thereof. Furthermore, the Office Action fails to explain what part of lower clutch 163 is a spline, which is conventionally defined as any of a series of projections on a shaft that fit into slots on a corresponding shaft, enabling both to rotate together.

Moreover, the Office Action fails to explain how Bae's upper clutch 161 constitutes a second spline shaft extended from a side of the ring gear toward the first spline shaft. Inspection of Fig. 2 of Bae, for example, clearly shows that upper clutch 161 does not extend from a side of the ring gear 131c, but is spaced well below ring gear 131c, and there is no first spline shaft in Bae toward which the second spline shaft can extend. Furthermore, claims 2, 3, 5 and 6 depend from claim 1 and contain the features, discussed above, that are not disclosed by Bae.

Accordingly, the Office Action fails to make out a *prima facie* case of anticipation of claims 1, 3, 5 and 6 by Bae.

Reconsideration and withdrawal of this rejection of claims 1-3, 5 and 6 are respectfully requested.

Claims 13, 19 and 20 stand rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent Application Publication US 2002/0166349 to Lim. This rejection is respectfully traversed.

Lim fails to disclose the claimed combinations of features recited in claims 13, 19 and 20.

Claims 13, 19 and 20 recite a combination of features including a rotation transmission means arranged between the inner tub and the induction motor, for transmitting a rotational force of the induction motor to the inner tub and the pulsator so that the inner tub and the pulsator are rotated in the opposite direction to each other with a rotational speed lower than a rotational speed of the induction motor in laundering operation, and for transmitting a rotational force of the induction motor to the inner tub and the pulsator so that the inner tub and the pulsator are rotated in the identical direction to each other with a rotational speed identical to the rotational speed of the induction motor in dehydrating operation.

When Lim's inner tub 15 and pulsator 17 are both rotated, they are both rotated in the same direction, either "normally or reversely as one body" (paragraphs [0087]-[0090]), whereas the claimed invention recites "the inner tub and the pulsator are rotated in the opposite direction to each other."

Accordingly, the Office Action fails to make out a *prima facie* case of anticipation of the claimed invention by Lim.

Thus, reconsideration and withdrawal of the rejection of claims 13, 19 and 20 are respectfully requested.

Rejections under 35 U.S.C. § 103

Claims 1, 3, 5 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,176,108 to Bae et al. ("Bae") in view of U.S. Patent 5,669,105 to Dausch et al. ("Dausch") and further in view of EP 0949374A1 to Koshiga et al. ("Koshiga"). This rejection is respectfully traversed.

A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

Because the rejection is based on 35 U.S.C. §103, what is in issue in such a rejection is "the invention as a whole", not just a few features of the claimed invention. Under 35 U.S.C. § 103, "[a] patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said

subject matter pertains."

The determination under section 103 is whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. See In re O'Farrell, 853 F.2d 894, 902, 7 USPQ2d 1673, 1680 (Fed. Cir. 1988). In determining obviousness, the Examiner must explain what the differences between the claimed invention and the prior art are and provide objective factual evidence to support a conclusion that it would be obvious to one of ordinary skill in the art to achieve the claimed invention, which includes those missing features.

In the second place, in rejecting claims under 35 U.S.C. §103, it is incumbent on the examiner to establish a factual basis to support the legal conclusion of obviousness. See, In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one of ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal Inc. v. F-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988), cert. denied, 488 U.S. 825 (1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a *prima facie* case of obviousness. Note, In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Eritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992).

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be suggested or taught by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA

1970). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

A showing of a suggestion, teaching, or motivation to combine the prior art references is an “essential evidentiary component of an obviousness holding.” C.R. Bard, Inc. v. M3 Sys. Inc., 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998).

This showing must be clear and particular, and broad conclusory statements about the teaching of multiple references, standing alone, are not “evidence.” See In re Dembiczak, 175 F.3d 994 at 1000, 50 USPQ2d 1614 at 1617 (Fed. Cir. 1999).

Moreover, a factual inquiry whether to modify a reference must be based on objective evidence of record, not merely conclusory statements of the Examiner. See, In re Lee, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002).

Bae does not anticipate claims 1-3 and 5-6 for reasons discussed above. Moreover, neither Dausch nor Koshiga are being applied to remedy the aforementioned deficiencies of Bae. Accordingly, even if one of ordinary skill in the art were properly motivated to modify Bae, as suggested, the modified version of Bae would still not render obvious the claimed invention.

Accordingly, the Office Action fails to make out a *prima facie* case of obviousness of claims 1-3 and 5-6 by Bae in view of Dausch and Koshiga.

Reconsideration and withdrawal of this rejection of claims 1-3, 5 and 6 are respectfully requested.

Claims 13, 19 and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lim in view of Dausch. This rejection is respectfully traversed.

Complete discussions of the Examiner's rejections are set forth in the Office Action, and are not being repeated here.

Lim does not anticipate claims 13 and 19-20 for reasons discussed above. Moreover, Dausch is not being applied to remedy the aforementioned deficiencies of Bae. Accordingly, even if one of ordinary skill in the art were properly motivated to modify Bae, as suggested, the modified version of Bae would still not render obvious the claimed invention.

Accordingly, the Office Action fails to make out a *prima facie* case of obviousness of claims 14,15 and 17 by Lim in view of Dausch.

Reconsideration and withdrawal of this rejection of claims 13 and 19-20 are respectfully requested.

Claims 14, 15, 17 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lim in view of Bae. This rejection is respectfully traversed.

Lim does not disclose the invention recited in claim13, from which claims 14, 15, 17 and 18 depend, for reasons discussed above. Moreover, Bae is not being applied to remedy the aforementioned deficiencies of Lim. Accordingly, even if one of ordinary skill in the art were properly motivated to modify Lim, as suggested, the modified version of Lim would still not render obvious the claimed invention.

Furthermore, the Office Action fails to provide objective factual evidence of proper motivation to modify Lim, as suggested.

Lim clearly operates properly without the need for a complex planetary gear system, and has no need to add a complicated, expensive planetary gear system thereto, especially when the Office Action fails to provide objective factual evidence that adding a complicated, expensive planetary gear system will improve operation of its device in a substantial manner. The motivation for doing this, according to the Office Action is to create a washing machine with a transmission to control the torque and speed of the drive shaft and to have a clutch that can do so in an unbalanced state. However, Applicants respectfully submit that Bae's clutch improvement is directed only to the prior art mentioned in Bae and that the Office Action fails to establish that Lim's clutch (circa 2002) suffers from the problems in the prior art of Bae (circa 1998).

Accordingly, the Office Action fails to make out a *prima facie* case of obviousness of claims 14, 15 and 17 by Lim in view of Bae.

Reconsideration and withdrawal of this rejection of claims 1-3, 5 and 6 are respectfully requested.

Claim 16 stands rejected under 35 USC §103(a) as being unpatentable over Bae in view of U.S. Patent 5,209,085 to Brien.

Bae does not anticipate claim 13, from which claim 16 depends, for reasons discussed above. Moreover, Brien is not being applied to remedy the aforementioned deficiencies of Bae. Accordingly, even if one of ordinary skill in the art were properly motivated to modify Bae, as suggested, the modified version of Bae would still not render obvious the claimed invention.

Furthermore, the Office Action fails to provide objective factual evidence of proper motivation to modify Bae, as suggested.

To establish a *prima facie* case of obviousness, Denso must show "some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." Fine, 837 F.2d at 1074, 5 USPQ2d at 1598. There is no suggestion to combine, however, if a reference teaches away from its combination with another source. See id. at 1075, 5 USPQ2d at 1599. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant . . . [or] if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." In re Gurley, 27 F.3d 551, 553, 31 USPQ2d 1130, 1131 (Fed. Cir. 1994).

Bae uses a direct drive system, i.e., one in which the drive motor is directly lined up with and connected to the tub. Brien, on the other hand, uses an indirect drive system, i.e., one in which the motor is located on a separate and parallel axis from the tub axis, and which employs a completely separate clutch/brake drive unit 1 from its drive motor. In other words, Brien teaches away from modifying a direct, in-line drive motor, with a large solenoid operated clutch unit completely separate from its motor.

Applicants respectfully submit that one of ordinary skill in the art would not be motivated to modify Bae to provide a solenoid operated clutch in view of Brien's disclosure that its clutch and its driving solenoid are not integrally provided, as they would have to be if Bae were modified, as

suggested.

These significant structural differences between these two references teach away from making the proposed modification of Bae.

Accordingly, the Office Action fails to make out a *prima facie* case of obviousness of claim 16 by Bae in view of Brien.

Reconsideration and withdrawal of this rejection of claims 13 and 19-20 are respectfully requested.

Allowable Subject Matter

The Office Action indicates that claims 7-12 would be allowable if rewritten in independent form. Applicants thank the Examiner for the early indication of allowable subject matter in this application.

Additional Cited References

Because the remaining references cited by the Examiner have not been utilized to reject the claims, but have merely been cited to show the state of the art, no comment need be made with respect thereto.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone Robert J. Webster, Registration No. 46,472, at (703) 205-8000, in the Washington, D.C. area.


Prompt and favorable consideration of this Amendment is respectfully requested.

Applicants respectfully petition under the provisions of 37 C.F.R. § 1.136(a) and § 1.17 for a one-month extension of time in which to respond to the Examiner's Office Action. The Extension of Time Fee in the amount of \$ 120.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachments: Abstract of the Disclosure and Five page Article concerning Planetary Gears

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5.4 Gear Trains

There are three main types of gear trains that we will consider. Simple gear trains have each gear on separate shafts. Compound gear trains have at least two gears on a common shaft. For simple and compound gear trains, the shafts rotate about their own axes, but the axes of the shafts are fixed in space. Planetary gear trains have at least one shaft axis, which rotates about another shaft axis. Figure 5.17 illustrates the three types of gear trains.

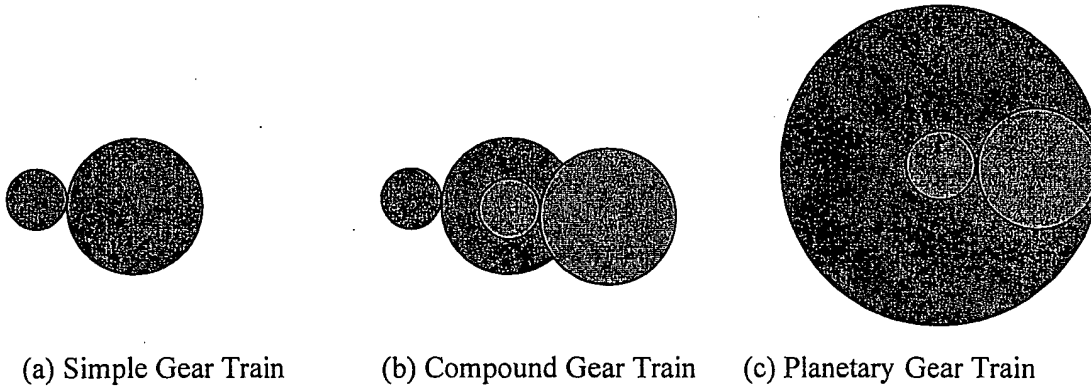


Figure 5.17: Example gear trains.

Simple and Compound Gear Trains

The speed ratios for simple and compound gear trains are determined in the same way, one gear pair at a time. The speed ratio for a pair of gears is obtained by considering the common tangential velocity at the point where the pitch circles are tangent, Figure 5.18.

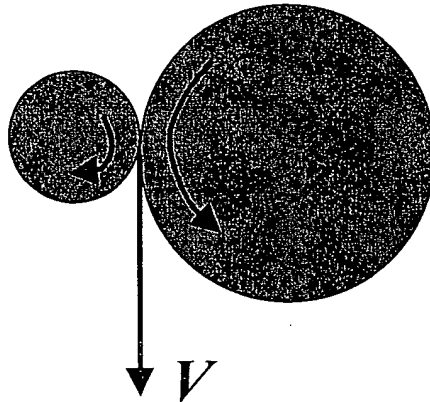


Figure 5.18: Common tangential velocity for a pair of meshing external gears.

The interface velocity is: $V = -\omega_2 r_2 = \omega_3 r_3$, where the gear on the left is gear 2, the gear on the right is gear 3, and it is assumed that counter-clockwise is positive. Rearranging, we get the ratio of the gear velocities:

$$\frac{\omega_2}{\omega_3} = \frac{n_2}{n_3} = -\frac{r_3}{r_2} = -\frac{N_3}{N_2}$$

Note that we often use ω to designate the rotational velocity in *rad/s*, and n to designate the rotational speed in *rpm*. Your textbook tends to use ω for both *rad/s* and *rpm*. The ratio of the two speeds is inversely proportional to the ratio of the number of teeth on the gears. A negative sign appears to indicate that the two gears are rotating in opposite directions. For *internal gears*, the two gears will rotate in the same direction, and there is no negative sign.

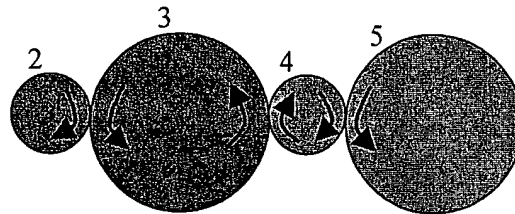


Figure 5.19: Simple gear train.

Figure 5.19 illustrates a simple gear train. It is composed of 3 pairs of gears, each representing a stage. The total gear ratio can be obtained by relating the individual speed ratios as follows:

$$\frac{\omega_2}{\omega_5} = \frac{\omega_2}{\omega_3} \frac{\omega_3}{\omega_4} \frac{\omega_4}{\omega_5} = \left(-\frac{N_3}{N_2} \right) \left(-\frac{N_4}{N_3} \right) \left(-\frac{N_5}{N_4} \right) = -\frac{N_5}{N_2}$$

For simple gear trains, the intermediate gears have no effect on the speed ratio as their contributions cancel out. Their only purpose is to change the direction of motion, and to separate the input and output gear shafts.

Larger speed ratios are obtained by compounding the gear train, as shown in Figure 5.20.

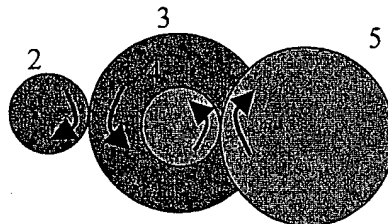


Figure 5.20: Compound gear train.

In this case, we have compounded gears 3 and 4, and the speed ratio is:

$$\frac{\omega_2}{\omega_5} = \frac{\omega_2}{\omega_3} \frac{\omega_4}{\omega_5} = \left(-\frac{N_3}{N_2} \right) \left(-\frac{N_5}{N_4} \right) = \frac{N_3 N_5}{N_2 N_4}$$

This can also be expressed as:

$$\left| \frac{n_{driver}}{n_{driven}} \right| = \frac{\text{product of number of teeth on driven gears}}{\text{product of number of teeth on driver gears}}$$

In this case, the direction of rotation should be obtained by inspection.

Planetary Gear Trains

Planetary gear trains, such as Figure 5.21, have a gear axis (the planet), which rotates about another axis (the sun).

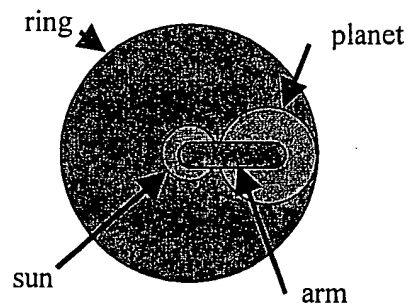


Figure 5.21: Planetary gear train nomenclature.

The arm is used to 'carry' the planet about the sun's axis, and represents the speed of rotation of the planetary axis. Note that this planetary gear train has two degrees of freedom. That is, two separate angular velocities must be fixed to ensure that the gear train cannot rotate. This means that we must know two 'input' angular velocities before we can specify the 'output' velocity. Note however, that one of these input velocities may be zero. Figure 5.22 illustrates both frontal and side views of a planetary gear train. This side view illustrates one way in which the rotational velocities can be transferred out of the planetary system, through concentric shafts. In practice, we will usually use schematic side views.

There are three methods specified in your textbook to establish the output velocity of a planetary gear train: the formula method, the tabular method and instant centres. We will consider only the formula method.

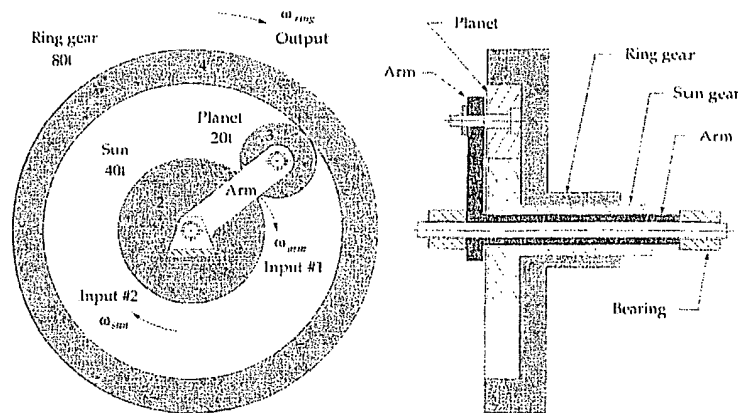


Figure 5.22: Front and side views of a planetary gear train.

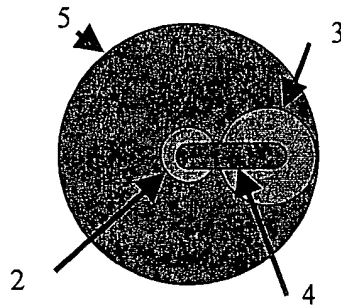


Figure 5.23: Planetary gear system for the development of the formula method.

Consider the planetary gear system illustrated in Figure 5.23. The arm is 'gear' 4 and the ground is link 1. The formula method relies on expressing the velocity of two gears with respect to the arm:

$$\omega_{24} = \omega_{21} - \omega_{41} = \omega_2 - \omega_4$$

$$\omega_{34} = \omega_{31} - \omega_{41} = \omega_3 - \omega_4$$

Here, an angular velocity with two subscripts is a relative velocity of the first link with respect to the second link. If the second link is ground (link 1), then the angular velocity is an absolute velocity, and is denoted using a single subscript. We now divide these two equations to get the desired formula:

$$\frac{\omega_{24}}{\omega_{34}} = \frac{\omega_2 - \omega_4}{\omega_3 - \omega_4}$$

Note that the velocities on the left-hand-side are each measured with respect to the arm (link 4). We can therefore establish the required velocity ratio by holding the arm fixed. If we do this, we are left with a non-planetary gear train. Therefore, the left-hand-side of our formula can always be established based on the ratio of the number of teeth in the system. This is always known. On the right-hand-side, we have three absolute velocities. Since we have a two degree-of-freedom system, two of these will be specified, and we can use the formula to determine the third.

Note that we derived the above formula involving gears 2 and 3 (as well as the arm, 4). We could also have used gear 5. To make the formula more generic, we usually express it as follows:

$$\frac{\omega_{LA}}{\omega_{FA}} = \frac{\omega_L - \omega_A}{\omega_F - \omega_A}$$

where L designates the 'last' gear, F designates the 'first' gear, and A designates the arm. We choose the first and last gears depending on what information is given in the problem, and what we are trying to solve for.